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ABSTRACT

This competency-based preservice home economics teacher education module on the metric system is the seventh in a set of seven modules on consumer education related to management. (This set is part of a larger series of sixty-seven modules on the Management Approach to Teaching Consumer and Homemaking Education [MATCHE]--see CE 019 901-967.) Following the module objective and overview, two units of instruction are presented: (1) understanding the metric system (with lessons on the history of the metric system, reasons for changing to metric, and metric terminology) and (2) weights and measures of the metric system (with a lesson on working with the metric system). Each lesson includes a narrative summary, suggested activities, and suggested resources (readings). A module pre/posttest (with answer key) concludes the document. (Workshop proceedings relating to the development of these modules are available in the ERIC system as CE 019 896-899; also available is a module on utilizing FHA-HERO as an instructional strategy to expand and strengthen the home economics instructional programs [CE 019 900].) (JH)

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CONSUMER APPROACH STRAND:

MANAGEMENT

MODULE I-F-7 THE METRIC SYSTEM

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1978

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CE 019 931

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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MATCHE

Management Approach to Teaching Consumer and Homemaking Education

MATCHE is an individualized, competency-based preservice curriculum designed for home economics education students at the preprofessional, upper division level. MATCHE is a comprehensive curriculum based on selected objectives which give emphases in three areas: 1) consumer approach to homemaking education, 2) teaching home economics in economically depressed areas, and 3) establishing occupational programs related to home economics. The material for each subject matter area of home economics has been organized into these three strands, and includes an FHA-HERO emphasis. These subject matter areas are home economics education core, housing, foods and nutrition, textiles and clothing, human development, and management.

The MATCHE modules were written by subject matter specialists from various colleges and universities offering home economics and therefore each is unique in the approach used for the development of the objectives. The modules allow for differences in level of achievement, rate of learning, and learning goals. They may be used independently, combined into a sequential series, or as a random set of conceptual units. Any instructor using the material can easily adapt the material to a specific group of students, the locale, method of instruction, and available facilities. Learning may be facilitated by offering one module in conjunction with others.

As MATCHE is continuously up-dated by those using the curriculum, some concepts and objectives may be added and others deleted. The purpose is to continually strengthen the program for pre and inservice home economics teachers.

Guidelines for Use and Continuous Development of MATCHE are on file with Home Economics units in each of the fifty state departments of education plus all of the Home Economics Departments in California institutions offering home economics education. This booklet and proceedings from the four MATCHE workshops give background information concerning the purpose and development of the MATCHE project.

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MATCHE PROJECT

1974-1978

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THE METRIC SYSTEM

Module Objective

The MATCHE student will be able to effectively and efficiently utilize weights and measurements of the metric system in a variety of situations.

Module Overview

The United States is in the process of changing from the use of standard weight and measures to the metric system. This module is designed to help prepare the student for that change. This is done through acquainting the student with the terminology of the metric system and through using the weights and measures in everyday situations.

This module has been divided into the following units:

Unit 1: Understanding the Metric System

Unit 2: Weights and Measures of the Metric System

UNIT 1

UNDERSTANDING THE METRIC SYSTEM

Objectives

The MATCHE student will be able to present briefly a history of the metric system.

The MATCHE student will be able to assess the reasons for changing to the metric system.

The MATCHE student will be able to identify the terminology, including units, symbols, and abbreviations used in the metric system.

Overview

The purpose of the unit is to inform you of the history of the metric system and why a conversion is being made. It will also familiarize you with the terminology used in the metric system.

Lesson 1: History of Metric System

Narrative Summary

The need for a simple worldwide system of measurement was recognized as early as the 1670s. It was not until 1790, during the French Revolution, that a simple and scientific unit of measure was established. The system was based on multiplying or dividing the basic units by ten. By 1900 most nations in Europe, and Central and South America had adopted the metric system. Since the 1950s, India, Japan, Britain, South Africa, New Zealand, Australia, and Canada have committed themselves to metric. The United States uses the system brought by the colonists from England. Use of the metric system was made legal but not mandatory in 1866. In 1968 a bill was passed authorizing a program of investigation, research, and survey to determine the impact on this country of the increasing worldwide use of the metric system and to determine what action should be taken by the United States. The report, released 1971, stated that the United States has slowly been "going metric" and will continue to do so regardless of national plans and policies.

Suggested Activities

1. Read the handout "Brief History of Measurement Systems" (Appendix A). Discuss your findings with other students and/or the instructor.

2. Write to your Congressman and obtain information regarding "metric" legislation. Share this information with the instructor.

3. Check the Federal Register to obtain information regarding "metric" legislation.

Suggested Resources

AMJ Publishing Company (published bi-monthly). American Metric Journal, Tarzana, California.

Hopkins, Robert A. The International (SI) Metric System and How It Works. Tarzana, California: AMJ Publishing Company, 1973.

Mulski, John H. "How Do You Measure Up--In Metrics?" School Shop, January, 1974.

Orange County Department of Education, A Metric Workbook for Teachers of Consumer and Homemaking Education. Santa Ana, California, 1973.

Penney, J. C. Insights into Consumerism: Moving Toward Metric, Fall/Winter 1974.

Polymetric Services, "America Goes Metric." Tarzana, California.

Superintendent of Documents, Brief History of Measurement Systems. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Commerce. A Metric America. A Report to Congress. National Bureau of Standards. Washington, D.C.: U.S. Government Printing Office, 1971.

U.S. Department of Commerce. Units of Weight Measure--International (Metric) and U.S. Customary. National Bureau of Standards. Washington, D.C.: Miscellaneous Publication 286, May, 1967.

U.S. Department of Commerce. "What About Metric?" National Bureau of Standards. Washington, D.C.: U.S. Government Printing Office, 1973.

Lesson 2: Reasons for Changing to Metric

In addition to the narrative summary, all of the resources and activities presented in this lesson will enable you to identify the reasons for changing to the metric system.

Narrative Summary

There are definite advantages and disadvantages to converting to the metric system. Advantages listed include:

1. Metric Is a Universal System. World trade is constantly growing. A changeover to the metric system could stimulate sales and help balance exports against imports.

2. The Metric System Is Easier To Use. The measuring units are interrelated and are also in multiples of 10 or divisible by 10.

3. Calculations Are Faster. The system is particularly adaptable to computers and calculators.

4. Less Chance of Error. Decimals replace fractions which in the conventional system make calculations slower and increase chance of error.

5. Interchangeability of Machine Parts. Adoption of the metric system could lead to universal standards for machine parts, permitting them to be used on machines of different makes.

6. Standardization of Tools and Gauges. Universal acceptance of tools would reduce the number of each that would be needed by industry and individual workers.

7. Especially Useful in the Laboratory. Tests and laboratory instruments are easily calibrated and simpler to read.

8. Eliminate Double Measuring System. Factories in both the United States and foreign countries must produce equipment for both metric and customary measurements. This double standard creates confusion and a greater cost.

9. All units divisible by 10 or the multiple of 10. Computations can be made correctly and with ease by merely changing the decimal.

Disadvantages listed include:

1. Reluctance to Change. Resistance to change is a natural human response. Educators and industry have a vital role to play in assisting the American population to more easily accept the changeover to the metric system of measurement.

2. Expense. The change to metric units by industry takes money. But with careful planning, much of it can be phased into the normal costs of replacement of equipment and machinery.

Suggested Activity

List various products produced in the United States that use metric measurement. What are the advantages of using metric system for these products versus the English system? Share your list with other members of the class and/or instructor.

Suggested Resource

U.S. Department of Commerce. A Metric America. A Report to Congress. National Bureau of Standards. Washington, D.C.: U.S. Government Printing Office, 1971.

Lesson 3: Metric Terminology

In addition to the narrative summary, all of the resources and activities presented in this lesson will enable you to identify the terminology, including units, symbols, and abbreviations used in the metric system.

Narrative Summary

The International System of Units--SI is a modernized version of the metric system established by international agreement. It provides a logical and interconnected framework for all measurements in science, industry, and commerce. Officially abbreviated SI, the system is built upon a foundation of seven base units. Multiples and sub-multiples are expressed in a decimal system. Use of metric weights and measures was legalized in the United States in 1866, and since 1893 the yard and pound have been defined in terms of the meter and the kilogram. The base units for time, electric current, amount of substance, and luminous intensity are the same for both the customary and metric systems.

The first class of units contains seven base units, namely: the meter, the kilogram, the second, the kelvin, the ampere, the candela, and the mole.

THE SEVEN BASE UNITS

QUANTITY	NAME OF UNIT	SI SYMBOL
length	metre	m
mass	kilogram	kg
time	second	s
thermodynamic temperature	kelvin	K
electric current	ampere	A
luminous intensity	candela	cd
amount of substance	mole	mol

The Metric System is based on the decimal system with a power base of 10 specified by:

prefixes		phonic	symbol
mega	1 000 000.	meg'a	M
kilo	1 000.	kil'o	k
hecto	100.	hek'to	h*
deca	10.	dek'a	da*
(basic units)	1.		
deci	0.1	des i	d
centi	0.01	sen'ti	c
milli	0.001	mil'i	m
micro	0.000 001	mi'kro	u*

*seldom used by consumer

basic units

			symbol
metre	measures	Length	m
gram	measures	Mass (weight)	g
litre	measures	Volume	l

Example: To convert units, just move the decimal point

161 centimetres 16.1 decimetres 1.61 metres

Suggested Activity

Study Appendixes listed below. Complete "Working in Metric Units (SI)" on the following pages and return to instructor.

Basic Facts of Metric System (Appendix B)
Rules for Writing Metrically (Appendix C)
Changing Units From One Prefix to Another (Appendix D)
Metric Stair Steps (Appendix E)

Completion of "Working in Metric Units (SI)" will serve as a Progress Test.

Working in Metric Units (SI)

NAME:_____ DATE:_____

I. Complete each of the following:

1. A millimeter can be written _____m
2. One centimeter can be written _____m
3. One meter can be written _____km
4. One millimeter can be written _____km
5. One milligram can be written _____g
6. One gram can be written _____kg
7. One kilogram can be written _____t
8. One millimeter can be written _____cm
9. One cubic centimeter is _____l
10. One liter is _____m^3

II. True or False. Write T or F whichever applies.

1. 10 mm = 1 cm _____
2. 100 cm = 1 meter _____
3. 1000 mm > 1 m _____
4. 1000 mm < 1 m _____
5. 1000 m > 1 km _____
6. 1000 m = 1 km _____
7. 1000 mg = 1 g _____
8. 1000 g = 1 kg _____
9. 0.001 kg = 1 g _____
10. 0.001 g. > 1 mg _____

11. 1000 milliliter = 1 l _____

12. 1000 cm^3 = 1 l _____

13. 0.001 liter > 1 cm^3 _____

14. 0.001 liter > 1 ml _____

15. 1 cm^3 of water weighs 1 g _____

16. 1 liter of water weighs 1 kg _____

17. 1 m^3 < 1000 l _____

18. 1 m^3 > 1000 l _____

III. Complete the following:

1. 0.001 meter = _____ mm

2. 0.021 meter = _____ mm

3. 0.321 meter = _____ mm

4. 1 cm = _____ mm

5. 1 cm = _____ m

6. 12 cm = _____ m

7. 12 cm = _____ mm

8. 0.9 meter = _____ cm

9. 0.001 liter = _____ ml

10. 0.032 liter = _____ cm^3

11. 0.126 liter = _____ ml

12. 0.001 g = _____ mg

13. 0.052 g = _____ mg

14. 0.126 g = _____ mg

15. 1.001 meter = _____ mm

16. 2.002 liters = _____ ml

Words to know: tenth, hundredth, thousandth, mass, area.

Symbols to know: cm^2, m^2, ml, cm^3, l, m^3, mm, cm, m, km, mg, g, kg, t.

IV. If one is to add, subtract, divide, or multiply units of measure, the same size unit in the conventional system, it is necessary to multiply or divide; and in most cases this must be done with paper and pencil. To convert metric units all that is necessary is to add zeros or change the position of the decimal point.

Convert each of the following:

1. 24.2 cm to mm _____mm
2. 6.2 m to mm _____mm
3. 20.1 km to m _____m
4. 36.2 cm to m _____m
5. 25 m to cm _____cm
6. 120 mm to cm _____cm
7. 1000 mm to m _____m
8. 250 ml to l _____l
9. 250 cm^3 to l _____l
10. 2 l to ml _____ml
11. 2 l to cm^3 _____cm^3
12. 25 mg to g _____g
13. 250 g to kg _____kg
14. 2500 kg to t _____t

V. Problems. Change each of the following:

1. 90 km/h to _____m/s.
2. 1800 m/s to _____km/h.
3. 300 kg/h to _____g/s.
4. 10 g/l to _____mg/ml.
5. 27000 km/h to _____m/s.

VI. Addition: (Note the ease of conversion and addition.)

	1. as milligrams	2. as grams	3. as kilograms
250 mg	_____mg	_____g	_____kg
+ 5 g	_____mg	_____g	_____kg
+ 23 kg	_____mg	_____g	_____kg

When you have completed this activity, check with your instructor and if no further activities are prescribed proceed to Unit 2.

UNIT 2

WEIGHTS AND MEASURES OF THE METRIC SYSTEM

Objective

The MATCHE student will be able to demonstrate a working knowledge of the weights and measurement of the metric system.

Overview

The purpose of this unit is to identify and use the weights and measures of the metric system.

Lesson: Working with the Metric System

Narrative Summary

Transition to metrics will not come quickly, nor will it be without difficulty, but America's decision to move from our cumbersome customary system to the simplicity and logic of the metric system is a decision whose time has come. You should use metrics as often as possible.

Suggested Activity

Study Appendix F. Complete the "Activity Book" (Appendix G). After consulting with the instructor, select an activity from the following:

a. Develop a fifteen to twenty minute video tape program explaining the metric system that can be used to teach secondary level students and adult education.

b. Develop a slide presentation on the metric system for use in junior and senior high schools and adult classes.

c. Design and construct bulletin boards for use in home economics classes to alert students to the metric system.

d. Develop a unit plan for teaching the metric system to a particular level of students in a home economics class. Make transparencies (See Appendix H). Share this information with the class and/or instructor.

e. Develop a workshop on metrication for an adult group.

f. Evaluate and develop a bibliography of metric cookbooks.

Suggested Resources

Agricultural Extension Service, Metrics in the Kitchen. Extension Folder 294-1974. University of Minnesota.

Ames, Stanley R. "The Joule--Unit of Energy," Journal of the American Dietetic Association, November 1970, pp. 415-419.

Batcher, Olive M. "Metrication and the Home Economist," Journal of Home Economics. February 1974, pp. 28-31.

Bracken, Peg. "The Metrified Forest: All Polyester and a Meter Wide," Family Circle. February 1974, p. 30.

Goucher, Claire, and Sophia Perry. "What Impact Will Metrication Have on Home Economics?" Forecast for Home Economics. March 1974, pp. F-14.

Joly, Roxee W. "Changing to the Metric System," NASSP Bulletin, November 1972, pp. 47-59.

Orange County Department of Education, A Metric Workbook for Teachers of Consumer and Homemaking Education. Santa Ana, California, 1973.

Parker, Frances J. "The Shift Toward Metric," Journal of Home Economics, November 1973, pp. 15-18.

Penney, J. C. Insights into Consumerism: Moving Toward Metric, Fall/Winter 1974.

Sokol, Louis F. "Education and Training in SI Units," The American Metric Journal, January/February 1974, pp. 11-14.

Warning, Margaret. "Start Now to Think METRIC," Journal of Home Economics, December 1972, pp. 18-21.

Young, Lorelle. "Milli's Metric Manual," California Home Economist, November 1973 and February 1974.

After you have completed this unit, you should be ready to take the Module Posttest. See your instructor.

APPENDIXES

UNITED STATES DEPARTMENT OF COMMERCE
PETER G. PETERSON, Secretary
NATIONAL BUREAU OF STANDARDS / LAWRENCE M. KUSHNER, Acting Director

Special Publication 304 A. Revised October, 1972

Brief History of

MEASUREMENT SYSTEMS

"Weights and measures may be ranked among the necessaries of life to every individual of human society. They enter into the economical arrangements and daily concerns of every family. They are necessary to every occupation of human industry; to the distribution and security of every species of property; to every transaction of trade and commerce; to the labors of the husbandman; to the ingenuity of the artificer; to the studies of the philosopher; to the researches of the antiquarian, to the navigation of the mariner, and the marches of the soldier; to all the exchanges of peace, and all the operations of war. The knowledge of them, as in established use, is among the first elements of education, and is often learned by those who learn nothing else, not even to read and write. This knowledge is riveted in the memory by the habitual application of it to the employments of men throughout life."

JOHN QUINCY ADAMS
Report to the Congress, 1821

Weights and measures were among the earliest tools invented by man. Primitive societies needed rudimentary measures for many tasks: constructing dwellings of an appropriate size and shape, fashioning clothing, or bartering food or raw materials.

Man understandably turned first to parts of his body and his natural surroundings for measuring instruments. Early Babylonian and Egyptian records and the Bible indicate that length was first measured with the forearm, hand, or finger and that time was measured by the periods of the sun, moon, and other heavenly bodies. When it was necessary to compare the capacities of containers such as gourds or clay or metal vessels, they were filled with plant seeds which were then counted to measure the volumes. When means for weighing were invented, seeds and stones served as standards. For instance, the "carat," still used as a unit for gems, was derived from the carob seed.

As societies evolved, weights and measures became more complex. The invention of numbering systems and the science of mathematics made it possible to create whole systems of weights and measures suited to trade and commerce, land division, taxation, or scientific research. For these more sophisticated uses it was necessary not only to weigh and measure more complex things—it was also necessary to do it accurately time after time and in different places. However, with limited international exchange of goods and communication of ideas, it is not surprising that different systems for the same purpose developed and became established in different parts of the world—even in different parts of a single continent.

The English System

The measurement system commonly used in the United States today is nearly the same as that brought by the colonists from England. These measures had their origins in a variety of cultures—Babylonian, Egyptian, Roman, Anglo-Saxon, and Norman French. The ancient "digit," "palm," "span," and "cubit" units evolved into the "inch," "foot," and "yard" through a complicated transformation not yet fully understood.

Roman contributions include the use of the number 12 as a base (our foot is divided into 12 inches) and words from which we derive many of our present weights and measures names. For example, the 12 divisions of the Roman "pes," or foot, were called *unciae*. Our words "inch" and "ounce" are both derived from that Latin word.

The "yard" as a measure of length can be traced back to the early Saxon kings. They wore a sash or girdle around the waist—that could be removed and used as a convenient measuring device. Thus the word "yard" comes from the Saxon word "gird" meaning the circumference of a person's waist.

Standardization of the various units and their combinations into a loosely related system of weights and measures sometimes occurred in fascinating ways. Tradition holds that King Henry I decreed that the yard should be the distance from the tip of his nose to the end of his thumb. The length of a furlong (or furrow-long) was established by early Tudor rulers as 220 yards. This led Queen Elizabeth I to declare, in the 16th century, that henceforth the traditional Roman mile of 5,000 feet would be replaced by one of 5,280 feet, making the mile exactly 8 furlongs and providing a convenient relationship between two previously ill-related measures.

Thus, through royal edicts, England by the 18th century had achieved a greater degree of standardization than the continental countries. The English units were well suited to commerce and trade because they had been developed and refined to meet commercial needs. Through colonization and dominance of world commerce during the 17th, 18th,

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and 19th centuries, the English system of weights and measures was spread to and established in many parts of the world, including the American colonies.

However, standards still differed to an extent undesirable for commerce among the 12 colonies. The need for greater uniformity led to clauses in the Articles of Confederation (ratified by the original colonies in 1781) and the Constitution of the United States (ratified in 1790) giving power to the Congress to fix uniform standards for weights and measures. Today, standards supplied to all the States by the National Bureau of Standards assure uniformity throughout the country.

The Metric System

The need for a single worldwide coordinated measurement system was recognized over 300 years ago. Gabriel Mouton, Vicar of St. Paul in Lyons, proposed in 1670 a comprehensive decimal measurement system based on the length of one minute of arc of a great circle of the earth. In 1671 Jean Picard, a French astronomer, proposed the length of a pendulum beating seconds as the unit of length. (Such a pendulum would have been fairly easily reproducible, thus facilitating the widespread distribution of uniform standards.) Other proposals were made, but over a century elapsed before any action was taken.

In 1790, in the midst of the French Revolution, the National Assembly of France requested the French Academy of Sciences to "deduce an invariable standard for all the measures and all the weights." The Commission appointed by the Academy created a system that was, at once, simple and scientific. The unit of length was to be a portion of the earth's circumference. Measures for capacity (volume) and mass (weight) were to be derived from the unit of length, thus relating the basic units of the system to each other and to nature. Furthermore, the larger and smaller versions of each unit were to be created by multiplying or dividing the basic units by 10 and its multiples. This feature provided a great convenience to users of the system, by eliminating the need for such calculations as dividing by 16 (to convert ounces to pounds) or by 12 (to convert inches to feet). Similar calculations in the metric system could be performed simply by shifting the decimal point. Thus the metric system is a "base-10" or "decimal" system.

The Commission assigned the name *metre* (which we now spell meter) to the unit of length. This name was derived from the Greek word *metron*, meaning "a measure." The physical standard representing the meter was to be constructed so that it would equal one ten-millionth of the distance from the north pole to the equator along the meridian of the earth running near Dunkirk in France and Barcelona in Spain.

The metric unit of mass, called the "gram," was defined as the mass of one cubic centimeter (a cube that is 1/100 of a meter on each side) of water at its temperature of maximum density. The cubic decimeter (a cube 1/10 of a meter on each side) was chosen as the unit of fluid capacity. This measure was given the name "liter."

Although the metric system was not accepted with enthusiasm at first, adoption by other nations occurred steadily after France made its use compulsory in 1840. The standardized character and decimal features of the metric system made it well suited to scientific and engineering work. Consequently, it is not surprising that the rapid spread of the system coincided with an age of rapid technological development. In the United States, by Act of Congress in 1866, it was made "lawful throughout the United States of America to employ the weights and measures of the metric system in all contracts, dealings or court proceedings."

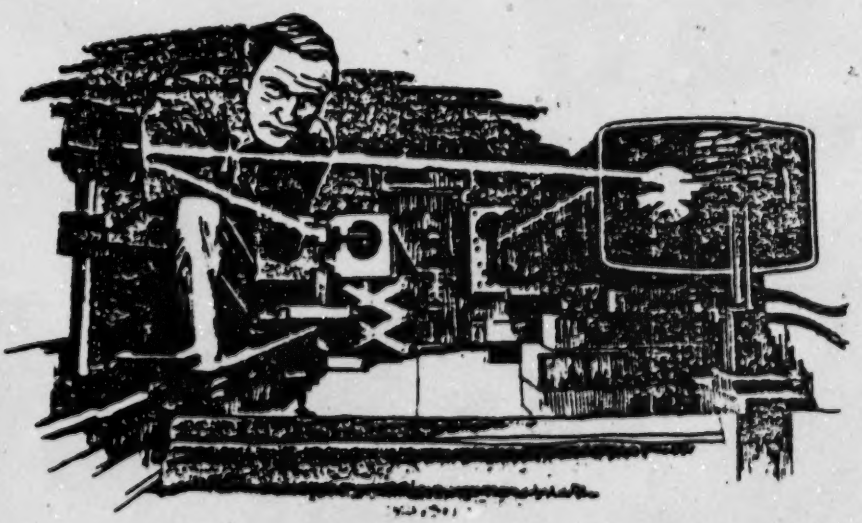
By the late 1860's, even better metric standards were needed to keep pace with scientific advances. In 1875, an international treaty, the "Treaty of the Meter," set up well-defined metric standards for length and mass, and established permanent machinery to recommend and adopt further refinements in the metric system. This treaty, known as the Metric Convention, was signed by 17 countries, including the United States.

As a result of the Treaty, metric standards were constructed and distributed to each nation that ratified the Convention. Since 1893, the internationally agreed-to metric standards have served as the fundamental weights and measures standards of the United States.

By 1900 a total of 35 nations—including the major nations of continental Europe and most of South America—had officially accepted the metric system. Today, with the exception of the United States and a few small countries, the entire world is using predominantly the metric system or is committed to such use. In 1971 the Secretary of Commerce, in transmitting to Congress the results of a 3-year study authorized by the Metric Study Act of 1968, recommended that the U.S. change to predominant use of the metric system through a coordinated national program. The Congress is now considering this recommendation.

The International Bureau of Weights and Measures located at Sevres, France, serves as a permanent secretariat for the Metric Convention, coordinating the exchange of information about the use and refinement of the metric system. As measurement science develops more precise and easily reproducible ways of defining the measurement units, the General Conference of Weights and Measures—the diplomatic organization made up of adherents to the Convention—meets periodically to ratify improvements in the system and the standards.

In 1960, the General Conference adopted an extensive revision and simplification of the system. The name *Le Système International d'Unités* (International System of Units), with the international abbreviation SI, was adopted for this modernized metric system. Further improvements in and additions to SI were made by the General Conference in 1964, 1968, and 1971.



☆ U.S. GOVERNMENT PRINTING OFFICE: 1975—O-595-451

Appendix B

BASIC FACTS OF METRIC SYSTEM (SI)

PLACE VALUES	Thousands	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths
MEANING	1,000	100	10	1	0.1	0.01	0.001
METRIC PREFIXES	kilometre	hectometre	dekametre	metre	decimetre	centimetre	millimetre
	kilolitre	hectolitre	dekalitre	litre	decilitre	centilitre	millilitre
	kilogram	hectogram	dekagram	gram	decigram	centigram	milligram
SYMBOLS	kilo- (k)	hecto- (h)	deka- (da)	metre (m) litre (l) gram (g)	deci- (d)	centi- (c)	milli- (m)

Source: Margaret Parsons
Graduate Student, Department of Home Economics
California State University, Fresno
Spring 1975

RULES FOR WRITING METRICALLY

1. The correct way to refer to the metric system is International System of Units, System International, or SI-Metric.

2. To avoid confusion, the correct writing of the symbols for SI units is very important. Examples of the most often used symbols are shown below.

   Example: Small k for kilo- Small m for metre
   Small c for centi- Small g for gram
   Small m for milli- Small l for litre

3. Pluralization of symbols should not be used.

   Example: 3 mm not 3 mms
   6 kg not 6 kgs
   4 cl not 4 cls

4. Never use a prefix without a unit either in speech or writing.

   Example: kilogram or kilometre not kilo
   millilitre or millimetre not milli

   NOTE: When possible use the script "ℓ" for litre because the typed "l" looks too much like a "one".

5. Use a zero in front of a decimal quantity that is less than one.

   Example: 0.531 mg not .531 mg
   0.8 cm not .8 cm

6. Never put a period after a symbol except at the end of a sentence.

   Example: 33 cm not 33 cm.
   18 km not 18 km.

7. When writing metrically it has been found preferrable to express numerical values in units between 0.1 and 1000.

   Example: 0.00394 m can be expressed as 3.94 mm
   0.3193 kg can be expressed as 319.3 g
   9393 cm can be expressed as 93.93 m

Source: Margaret Parsons
Graduate Student, Department of Home Economics
California State University, Fresno
Spring 1975

CHANGING UNITS FROM ONE PREFIX TO ANOTHER

kilo-	hecto-	deka-	(base)	deci-	centi-	milli-
1,00	100	10	1	0.1	0.01	0.001

LARGER PREFIXES ←——— • ———→ SMALLER PREFIXES

Example: To convert units just move the decimal point.

1.61 metres 16.1 decimetres 161 centimetres 1610 millimetres

and

1.61 metres 0.161 dekametres 0.0161 hectometres 0.00161 kilometres

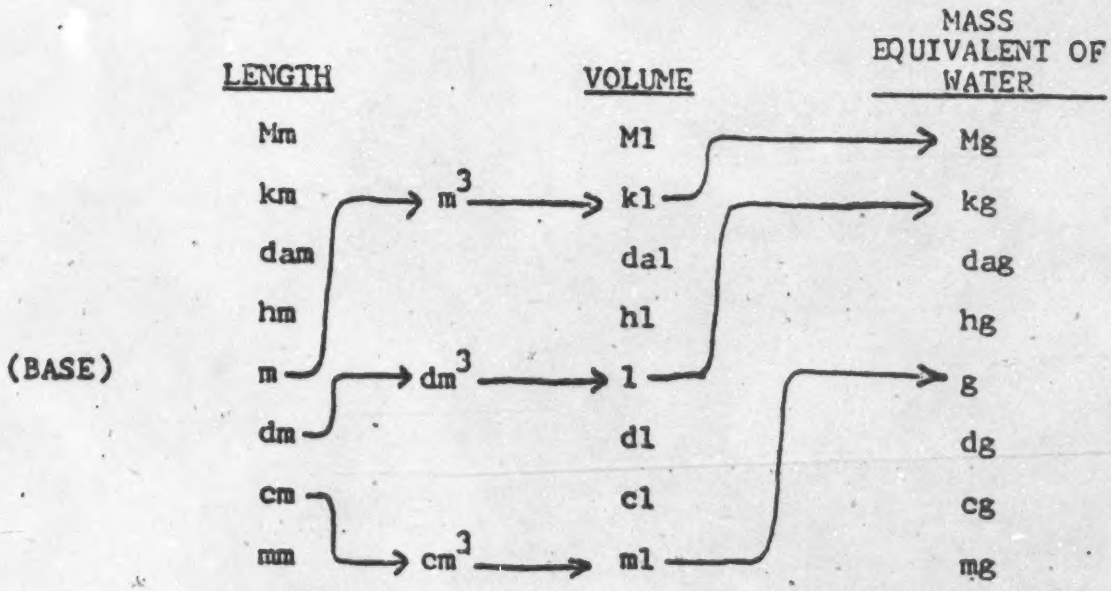
1. A number changed to a larger prefix will be smaller.
2. A number changed to a smaller prefix will be larger.
3. When moving the decimal point, count the number of places you are moving.

   Example: 1.61 metres → 16.1 decimetres → 161 centimetres

   Between metre and centimetre is <u>three</u> steps or places, therefore decimal point must be moved three places.

Source: Margaret Parsons
Graduate Student, Department of Home Economics
California State University, Fresno
Spring 1975

Appendix E



THE METRIC STAIR STEPS

Source: Margaret Parsons
Graduate Student, Department of Home Economics
California State University, Fresno
Spring 1975

Appendix F

Metrics IN THE Kitchen

Mary Darling

What is the Metric System?

Since the 1890's, the metric system of weights and measures has been the official United States system, but we have not succeeded in converting our everyday uses to the metric system. The United States is the only major nation not committed to using the metric system, but in the long run our position in world trade would benefit by converting.

Developed in France at the time of the Revolution (1790's), the metric system has been refined in many ways. The up-to-date version, on which the nations of the world have agreed, is called Système International d'Unités (SI) or the International Metric System.

During the past few years, the United States government asked many citizens, professional groups, and industry to study the question of whether the United States should convert to the metric system. After weighing evidence presented by participants, it was recommended that the United States should change to the metric system through a coordinated national program. (This report to the Congress is entitled, "A Metric America: A Decision Whose Time Has Come," /NBS-SP345/ for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402 – $2.25. Reports on substudies, such as Education and the Consumer, also are available – $1.25 each.)

Scientists and engineers have used the metric system in this country for many years. You may use the metric system and not realize it. For example, the width of photographic film is expressed in millimeters and skis are sold in centimeter sizes. Have you ever run 100 meters or followed a diet that counted grams of carbohydrate or protein? These metric terms are familiar.

The change to the metric system probably will occur over a period of time defined by the U.S. Congress, such as ten years. The customary system and metric system will coexist in our homes, some people feeling more comfortable with one than the other. Eventually, the marketplace will require everyone to use the metric system so we can be intelligent consumers. Could a gas station attendant put 40 liters of gasoline into a car? How many servings are in a 2 kilogram pot roast?

Changing our system of weights and measures is like giving up a comfortable pair of shoes. The change can be made a little easier by preparing for it, such as becoming acquainted with words used in the metric system.

Five Stages Toward Adoption

There is a difference between being familiar with a system and being able to use it without converting; the goal, in this case, is to THINK in metric rather than customary measurement.

Margaret Warning, in an article in the Journal of Home Economics, December, 1972, said that researchers have found five stages people advance through before they adopt a new habit—in this case, using the metric system.

The first stage in learning to "think metric" begins when a person hears that the U.S. probably is going to change to the metric system soon. This is the AWARENESS stage. A surprising number of persons whose everyday lives will be affected by conversion to the metric system do not realize that the United States is now the world's only large country that has not made a national commitment to convert to the metric system.

An INFORMATION–GATHERING stage follows awareness. At this point the person begins to ask questions: What are the six metric units? What do the prefixes mean and how are they used? What in the metric system is different from the present system and what is similar? What are the advantages and the disadvantages for the individual in her own particular circumstances? At this stage, too, she acquires small, relatively inexpensive tools and measuring devices such as metric tape measure, rulers, metric stick, thermometer, a scale, and probably some handy conversion tables.

Now she is ready for the APPLICATION stage. She begins to apply her knowledge. She notes her height, weight, and measurements in metric dimensions and units. She consults the thermometer to gauge the weather outside, but with an eye for degrees Celsius. She calculates the speed at which she is driving. Gradually this practice leads to the TRIAL stage.

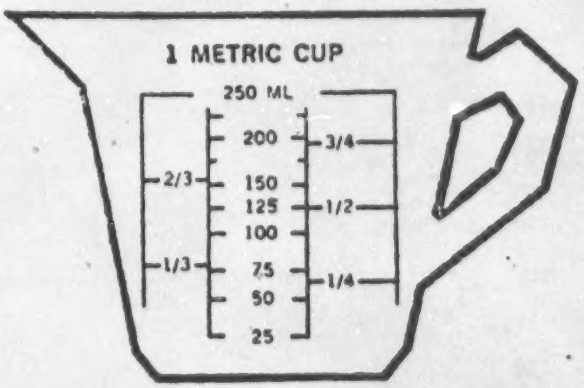
During this period she uses the metric system more and more frequently. If she finds the trial runs successful and pleasant, she almost forgets the old system.

By the time she has reached the ADOPTION stage, the learner is no longer a neophyte but has begun to think in metric terms. Furthermore, she has become an enthusiast. She is convinced of the new system's superiority, argues in its favor, and enjoys demonstrating its advantages.

Implicit in each stage, of course, are the individual's eagerness to learn and willingness to practice, steadily and consistently. Alfred Harper, University of Wisconsin, said, "It is always disconcerting to have generally accepted terminology displaced, just as it is to have generally accepted information or beliefs proved false. Both make it necessary to relearn . . . a harder process than learning initially, because it involves not only acquiring new concepts but also discarding some that are well worn and comfortable."

Food Preparation

At first glance it may seem that the metric system will change all of our food preparation, but keep in mind that many meals are prepared without any recipes. We also use many foods in the market units in which we buy them. For example, a can of tuna fish, a package of noodles, and a can of soup may be the measures used in preparing a casserole. Some day, however, you may want to try a new recipe that uses metric measurements instead of customary measures. A salad dressing recipe may call for 250 milliliters of oil. How much is that? New measuring cups are being designed that may look like the illustration and you may want to buy a new cup.



You also may need to buy a small scale to keep on the kitchen counter to measure grams of dry ingredients (flour, sugar) or solid fats. In countries that have the metric system, some women use a scale to weigh ingredients, but usually they find the measuring cup (volume) is the easiest way to measure ingredients.

Measuring spoons may have the same relationship to the metric cup as they have to our customary cup. (1 tablespoon = 1/16 cup, 1 teaspoon = 1/3 tablespoon). Or they may have a metric measure, such as 1 tablespoon = 15 milliliters. The first alternative seems more likely. A good cook will still taste her food and will know if she needs more seasoning.

As baking pans and casseroles need to be replaced, a new measure will indicate their size.

Temperature

Thermostats and thermometers will change from the Fahrenheit scale to the Celsius (Centigrade) scale. Until you are familiar with the Celsius scale, you may want to keep a chart of both temperature scales so you can use new appliances with old recipes – or new recipes with old appliances.

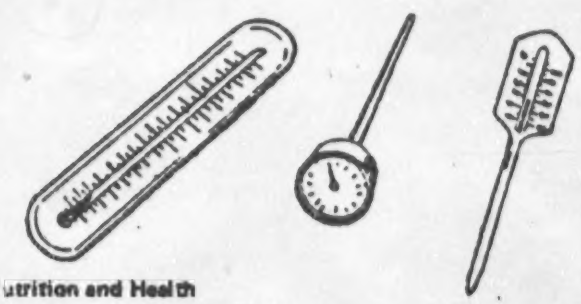
Thermometers are not needed all the time. The words to describe various methods of cooking will continue to be used. Words like freeze, chill, lukewarm, simmer, boil, and melt tell us what to do without a thermometer.

Thermometers are needed when making candy, roasting meat, or checking your freezer temperature.

Cooking Temperatures for Foods: Fahrenheit and Celsius Scales*

Cooking operation	Temperature °F	Temperature °C	Possible rounding of temperatures °C
Baking: Oven temperatures			
Very slow	250 and 275	121 and 135	120 and 135
Slow	300 and 325	149 and 163	150 and 165
Moderate	350 and 375	177 and 190	175 and 190
Hot	400 and 425	205 and 218	205 and 220
Very hot	450 and 475	232 and 246	230 and 245
Roasting: Internal temperatures: Beef			
Rare	140	60	60
Medium	160	71	70
Well-done	170	77	80
Deep-fat frying			
Chicken	350	177	175
Doughnuts, fish	350 to 375	177 to 190	175 to 190
Cauliflower, onions	375 to 385	190 to 196	190 to 195
Potatoes	385 to 395	196 to 201	195 to 200
Candy-making			
Thread	230 to 234	110 to 112	
Soft ball	234 to 240	112 to 115	
Firm ball	244 to 248	118 to 120	No rounding
Hard ball	250 to 266	121 to 130	
Soft crack	270 to 290	132 to 143	
Hard crack	300 to 310	149 to 154	
Refrigeration and freezer			
	-10	-24	
	0	-18	
	32	0	
	40	5	
	50	10	

*Source: Handbook of Food Preparation. Washington, D.C.: American Home Economics Association. Revised 1964. (Additional information is calculated from figures in the Handbook.)



Nutrition and Health

People trained in the sciences already use the metric system. Nutritionists measure food nutrients in grams, milligrams, and micrograms. The unit of measuring energy will change from the calorie to the joule (jool). (1 kilocalorie = 4.18 kilo joule)

Next time you have a physical check-up, ask for your weight in kilograms instead of pounds. You may be pleasantly surprised. Also, check your waistline in centimeters. Another surprise!

Shopping for Food

Quick now, how many quarts are there in a bushel? How many ounces in a liquid quart or a dry pound? It can be confusing. Although it may be uncomfortable at first, the metric system will provide an easier way to weigh and measure than our present system does.

One thing that won't happen, we will not have a slavish conversion of customary measures to metric measures. A pound box of candy will include a few more chocolates to make it weigh ½ kilogram (kg). A quart of milk will have a smidgeon more milk added to become a liter.

Have you noticed metric measurements on some of your groceries? Canned fruit and vegetable weights are indicated in both ounces and grams. Canned juice volume is measured in ounces and liters. These metric measurements are now voluntary. Read some labels to find out how many grams are in a can of soup or box of crackers. Unless container sizes are standardized, the metric system doesn't offer any advantages when comparing prices. Containers of the same size can be compared easily under any system.

Most meat markets use a decimal system to price meat. A package of ground beef is labeled 1.50 lb.—not 1 lb., 8 oz. When the metric system is used the same size package of ground beef will weigh .75 kg.

Some things probably won't change. A dozen eggs and a dozen cookies probably will always be. The unit of 12 is attractive because it can be divided in half, thirds, or quarters.

Appendix G

Activity Book

Adapted from: Orange County Department of Education, A Metric Workbook for Teachers of Consumer and Homemaking Education. Santa Ana, California, 1973.

STATION 1. "BODY MEASUREMENTS"

Supplies at the Station

Tape measure
meter stick on wall
bathroom scale

Steps

1. Using the tape measure, meter stick on wall and bathroom scale, fill in the blanks as to your height, weight (mass), and body dimensions as indicated.

2. I am _____ cm tall, or

_____ dm tall, or

_____ m tall.

EXAMPLE

I am 164 cm, or 16.4 dm, or 1.64 m.

Which of the above measurements would become the most commonly used? _____.

3. My measurements are:

	Bust/Chest	Waist	Hips
mm, or	_____	_____	_____
cm, or			
dm, or			
m			

Which measurement would be most commonly used? _____

Have you ever considered a 3-foot bustline or a yard bustline?

YES _____ NO _____

4. My body mass (weight) is: _____ kg, or

_____ g

STATION 2. "VOLUME"

Supplies at the Station

250 ml measuring cup
empty quart container
empty 7 Up bottle
filled 7 Up bottle
tea cup (1)
Drinking glass (1)

Steps

1. Fill the measuring cup to 100 ml. Pour this into the empty 7 Up bottle.

   Now estimate with your eye how many ml in the full 7 Up bottle?

   _____ ml.

2. To check your estimate, fill the empty 7 Up bottle until it is even with the full, capped bottle. Pour the water back into the measuring cup to measure the contents of the bottle.

   What are the actual contents of the 7 Up bottle?

   _____ oz. _____ ml.

   How far off was your guess? _____ ml.

3. In measuring typical servings, decide upon an amount which could be used in millimeters for:

   An average tea cup serving _____ ml

   An average drinking glass serving _____ ml

4. Fill the empty quart bottle just to the neck, below cap threads, with exactly one litre of water.

   Did all the water fit? _____Yes _____No

   Approximately how much water was left in the measuring cup?

   _____ oz _____ ml

STATION 3. "ACCURACY OF METRICS"

Supplies at the Station

metric gram scale
flour
wax paper
dry measuring cup
large spoon
sifter
metal spatula

Steps

1. Measure and weigh one cup flour by the following methods:

   (a) Scoop flour out of container with measuring cup, level off and weigh (cup and all).

   One cup flour weighs _____ g

   (b) Sift flour onto wax paper, spoon lightly into the cup, level and weigh (cup and all).

   One cup flour weighs _____ g

   (c) Sift flour directly into the cup (hold over a piece of wax paper to catch spillage) level and weigh (cup and all).

   One cup flour weighs _____ g

   How many grams should you subtract from each weighing to determine the actual weight of the flour?

   _____ g

2. Did the three measurements differ in weight? The difference between the lowest and the highest weight was:

   Highest weight _____g

   Lowest weight _____g

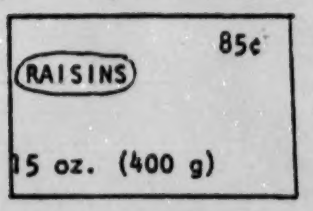
   Difference _____g

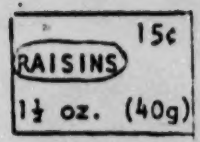
3. What conclusions can you make regarding chances of error in various recipes?

STATION 4. "GROCERY ITEMS"

Supplies at the Station

miscellaneous empty grocery containers





Steps

1. On grocery item, calculate the unit price according to customery measures (price per ounce). What is the price per ounce of the large package? _____¢.

   What is the price per ounce of the smaller package? _____¢

   Which is the better buy? _____.

2. On grocery item, calculate the unit price according to metric measures (price per gram). What is the price per gram of the larger package? _____¢

   What is the price per gram of the small package? _____¢

   Which is the better buy?

3. Which system was easier to use? _____.

4. Observe the grocery items. Their contents are listed conventionally as well as metrically. List the different units that you found. Then decide why each unit was used for the item.

UNIT	REASON

STATION 5. "COMMERCIAL PATTERN"

Supplies at the Station

metric equivalency chart
body measurements in inches chart
body measurements in centimetres chart
metre stick
20 cm rule

Steps

1. According to your normal dress/suit size, what are your body measurements?

Bust/Chest _____ inches

Waist _____ inches

Hip _____ inches

Looking at the "body measurements in centimetres," what are these same measurements in centimetres?

Bust/Chest _____ cm

Waist _____ cm

Hip _____ cm

Would you express a bust/chest measurement in metres?

_____ YES _____ NO

2. How many millimetres in 5/8"? _____ mm

How many centimetres in 5/8"? _____ cm

How wide is one centimetre? ("body ruler") _____

Draw a line one cm long _____

3. How many metres in 4 5/8 yards _____ m

Find .25 m on the metre stick.

4. How long is a nine inch zipper? _____ cm

STATION 6. "LENGTH"

Supplies at the Station

Metre stick
20 cm ruler

Steps

1. Make your own "body ruler."

   Which of your finger nails is almost one cm wide? _____

   How far is your span between the end of your thumb and the end of your little finger? _____cm.

   Measure the length of your pace (average step). Measure from the back of your heel on each step.

   My pace is _____ cm.

2. Using your "body ruler," estimate the size of the side of the table where you are working. _____ cm

3. Using the metre stick, calculate the height of the table at which you are working? _____ cm

4. What is the chair's sitting height? _____cm

5. What is the length of the "plastic" fabric?

   _____ cm or _____ m

6. How many centimetres are in a decimetre? _____ cm

7. How many centimetres are in 2/3 metre? _____cm

8. How many millimetres are in 2/3 metre? _____mm

STATION 7. "COOKING WITH METRICS"

Supplies at the Station

"Cooking with Metrics" Chart

Convert the following recipe to metric measure.

CHOCOLATE CHIP COOKIES

CUSTOMARY MEASURE	METRIC MEASURE	DIRECTIONS
Oven: 350°F	Oven: 177°C	Preheat oven.
		Sift together and set aside.
1/2 C + 1 T (sifted)	_____	Flour
1/4 tsp.	_____	Baking soda
1/4 tsp.	_____	Salt
		Combine and beat together until creamy:
1/4 C	_____	Butter or vegetable shortening
3 T	_____	Granulated sugar
3 T (packed)	_____	Brown sugar
1/4 tsp.	_____	Vanilla
1/4 tsp.	_____	Water
		Beat in 1 egg Add flour mixture: mix well Stir in:
3 oz.	_____	Chocolate chips
1/4 C	_____	Chopped nuts
		Drop by well-rounded 15 millilitre spoons onto ungreased cookie sheet. Bake 10-12 minutes or until brown. Makes 25 cookies.

METRICS

More and more involvement in metrics related to the consumer indicate the direction for measuring food items will be by volume rather than by weight. Items to be measured by weight would be meat products, bulk staple items, and other grocery items normally purchased now by the pound. Recipe items measured in volume will use the approximate measures listed here:

OUNCES	STANDARD UNIT	MILLILITRES	LITRES
	1/8 tsp	.5	.0005
	1/4 tsp	1	.001
	1/2 tsp	2.5	.0025
	1 tsp	5	.005
	2 tsp	10	.01
	(3 tsp)		
1/2 oz	1 T	15	.015
1 oz	2 T	30	.03
2 oz.	1/4 cup	60	
3 oz.		90	
4 oz.	1/2	120	
5 oz.		150	
6 oz	3/4 cup	180	

(Taken from "Cooking with Metrics," a set of recipe cards available for $5.50 from BHU, 23358 Hartland St., Canoga Park California 91307)

OUNCES	STANDARD UNIT	MILLILITRES	LITRES
7 oz		210	
8 oz	1 cup	240	.24
9 oz		270	
10 oz	3/4 cup	300	.3
11 oz		330	
12 oz	1 1/2 cup	360	
13 oz		390	
14 oz.	1 3/4 cup	420	
15 oz.		450	
16 oz	(2 cups) 1 pint	480	.48
32 oz	(2 pints) (1 quart) (4 cups)	960	.96
128 oz	(1 gallon) (4 quarts)	3840	3.84

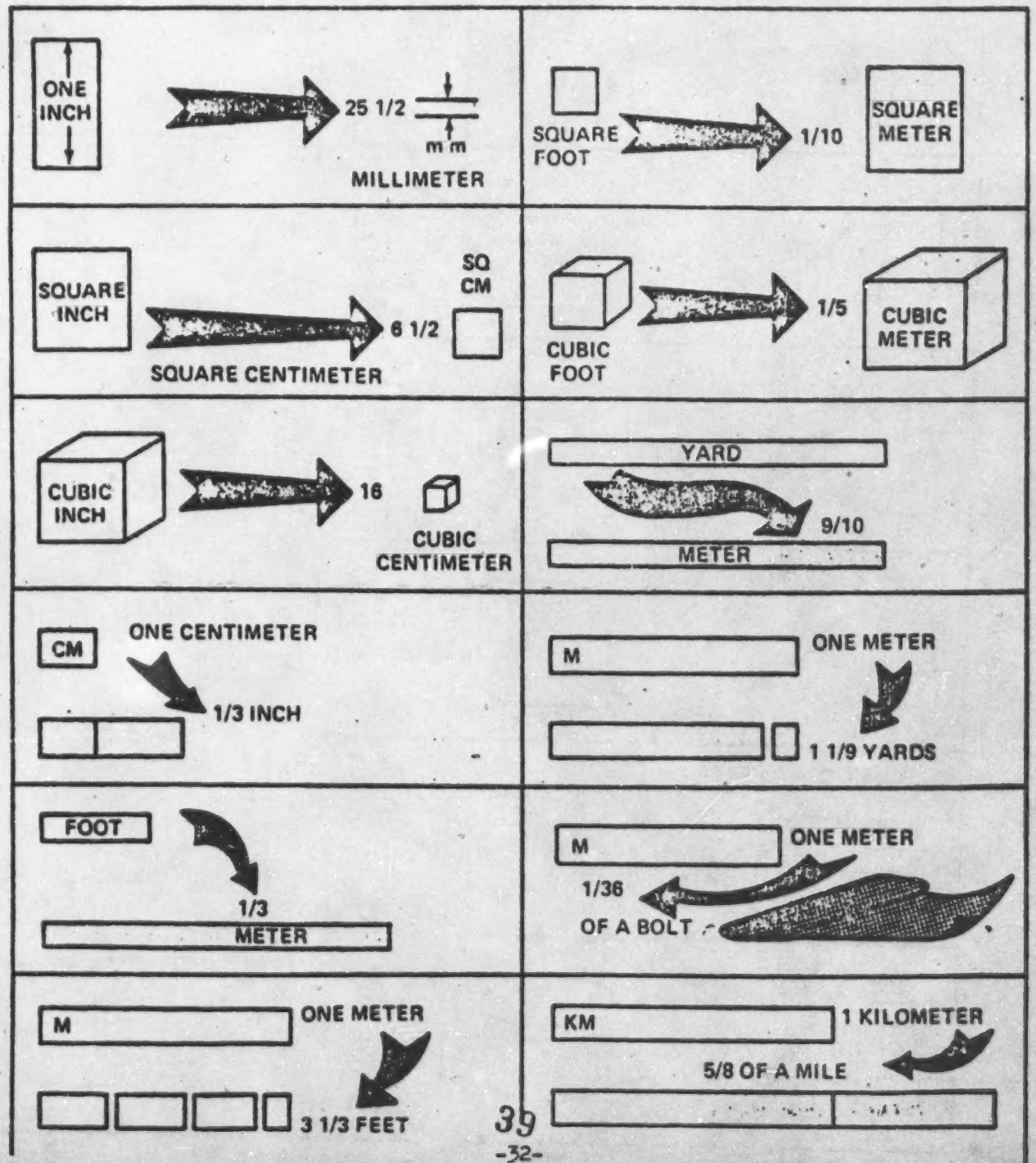
Appendix H

For Use on Bulletin Boards
or as Transparencies

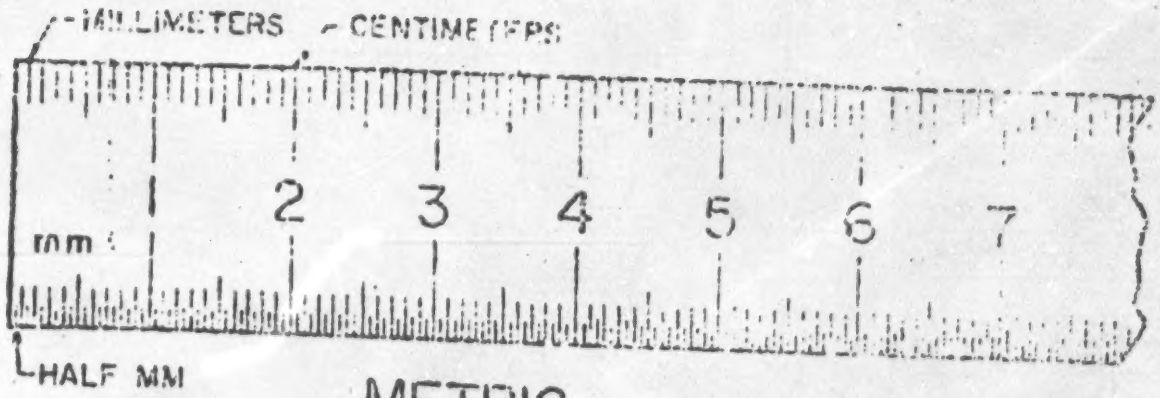
38

Graphical Metrics

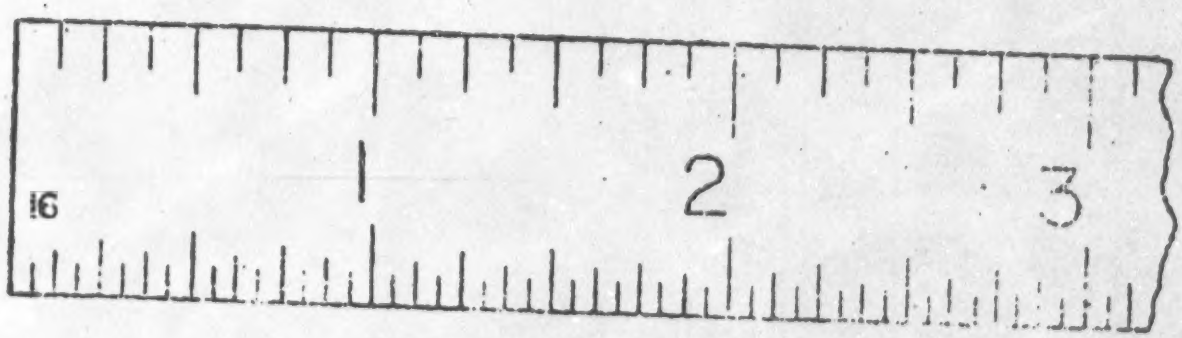
The following chart is a graphical representation of some common metric conversions. To aid in the understanding of this chart, approximate conversion factors were used.



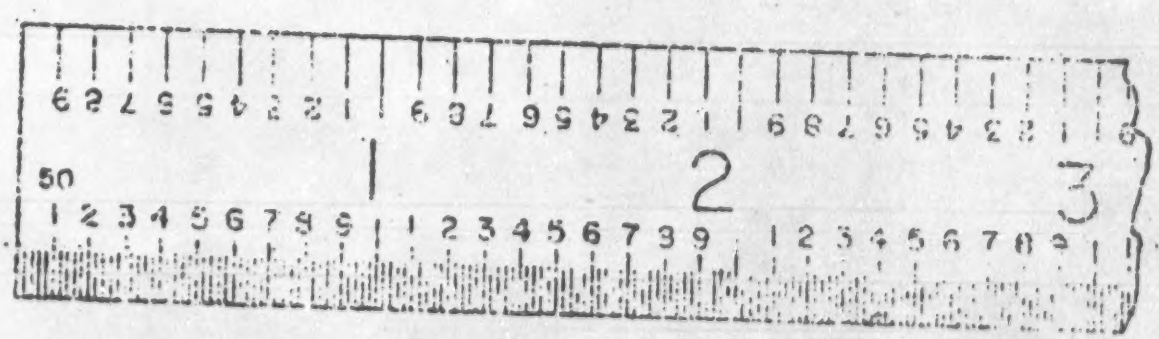
MILE
KILOMETER
1 5/8
28 GRAMS
GR
ONE OUNCE
QUART
9/10
LITER
ONE GRAM
GR
1/28 OF AN OUNCE
ONE LITER
L
2 1/10 PINTS
7.1 GRAMS
GR
ONE TEASPOON
ONE LITER
L
1 1/20 QUARTS
14.3 GRAMS
GR
ONE TABLESPOON
ONE LITER
L
1/4 GALLON
LB
POUND
7/16
KG
KILO
GRAM
946 CUBIC CENTIMETERS
CC
ONE QUART
ONE KILOGRAM
2 1/5 POUNDS
35 1/4 LITERS
ONE BUSHEL
TON
(SHORT)
2000 LBS.
9/10
METRIC
TON



METRIC



FRACTIONAL INCH



DECIMAL INCH

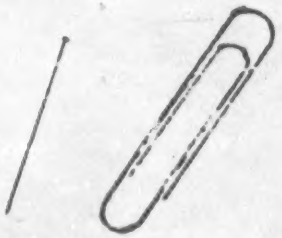
VISUALIZE METRIC MEASUREMENTS

METER

1 METER (APPROX 39 INCHES)

1 YARD

MILLIMETER



THE HEAD OF A COMMON PIN (OR THE WIRE DIAMETER OF A STANDARD PAPER CLIP) = 1 MILLIMETER

CENTIMETER

YOUR SMALL FINGERNAIL IS APPROX 1 CENTIMETER WIDE (A LITTLE LESS THAN 1/2 INCH)

All You Will Need to Know About Metric

(For Your Everyday Life)

Metric is based on Decimal system

The metric system is simple to learn. For use in your everyday life you will need to know only ten units. You will also need to get used to a few new temperatures. Of course, there are other units which most persons will not need to learn. There are even some metric units with which you are already familiar, those for time and electricity are the same as you use now.

BASIC UNITS

METER: a little longer than a yard (about 1.1 yards)
LITER: a little larger than a quart (about 1.06 quarts)
GRAM: about the weight of a paper clip

(comparative sizes are shown)

1 METER

1 YARD

25 DEGREES FAHRENHEIT

25 DEGREES CELSIUS

COMMON PREFIXES

(to be used with basic units)

Milli: one-thousandth (0.001)
Centi: one-hundredth (0.01)
Kilo: one-thousand times (1000)

For example:
1000 millimeters = 1 meter
100 centimeters = 1 meter
1000 meters = 1 kilometer

1 LITER 1 QUART

OTHER COMMONLY USED UNITS

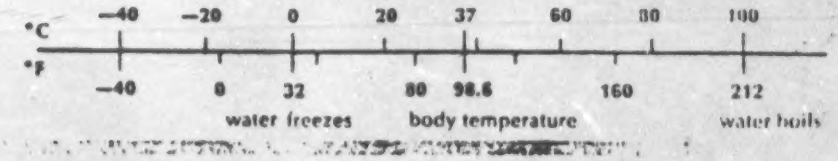
Millimeter:	0.001 meter	diameter of paper clip wire
Centimeter:	0.01 meter	width of a paper clip (about 0.4 inch)
Kilometer:	1000 meters	somewhat further than ½ mile (about 0.6 mile)
Kilogram:	1000 grams	a little more than 2 pounds (about 2.2 pounds)
Milliliter:	0.001 liter	five of them make a teaspoon

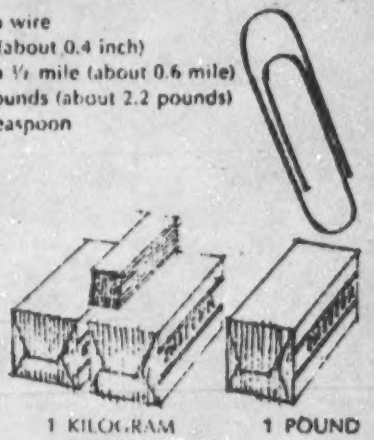
OTHER USEFUL UNITS

Hectare: about 2½ acres
Tonne: about one ton

TEMPERATURE

degrees Celsius are used





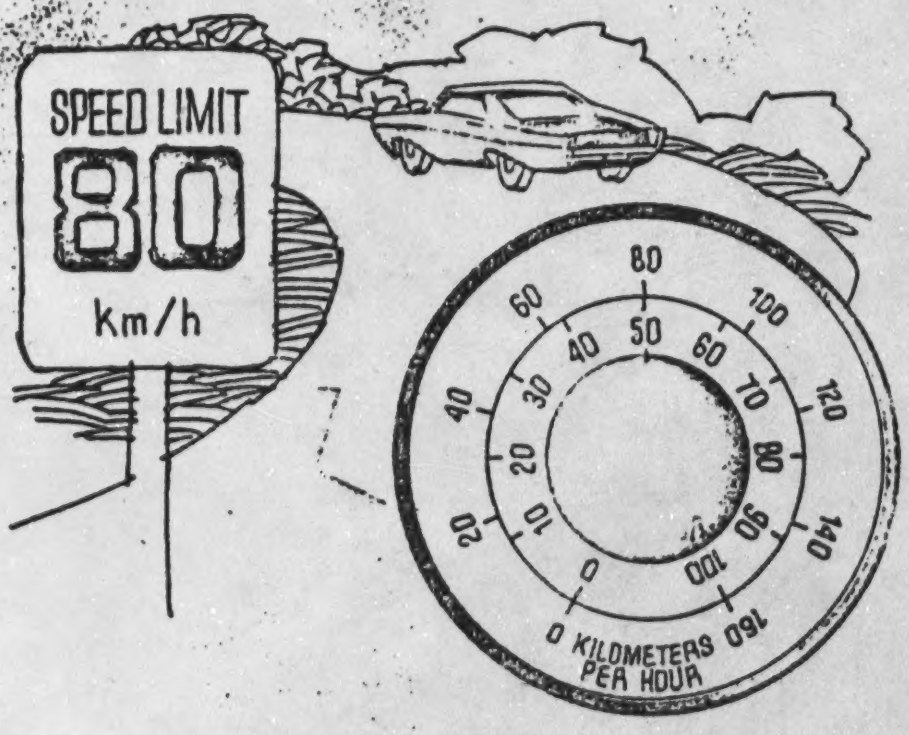
1 KILOGRAM 1 POUND

For more information, write to: Metric Information Office, National Bureau of Standards
Washington, D.C. 20234

Note This chart may be reproduced

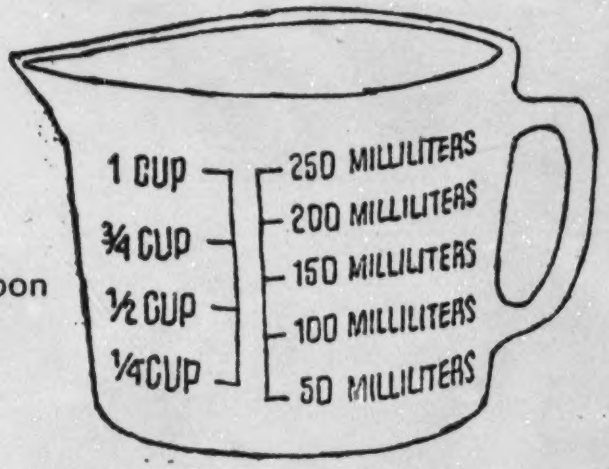
Source: U.S. Department of Commerce. What About Metrics? National Bureau of Standards, October, 1973.

LENGTH

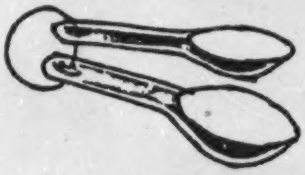


30 centimeters = 1 foot

3 VOLUME



5 milliliters = 1 teaspoon

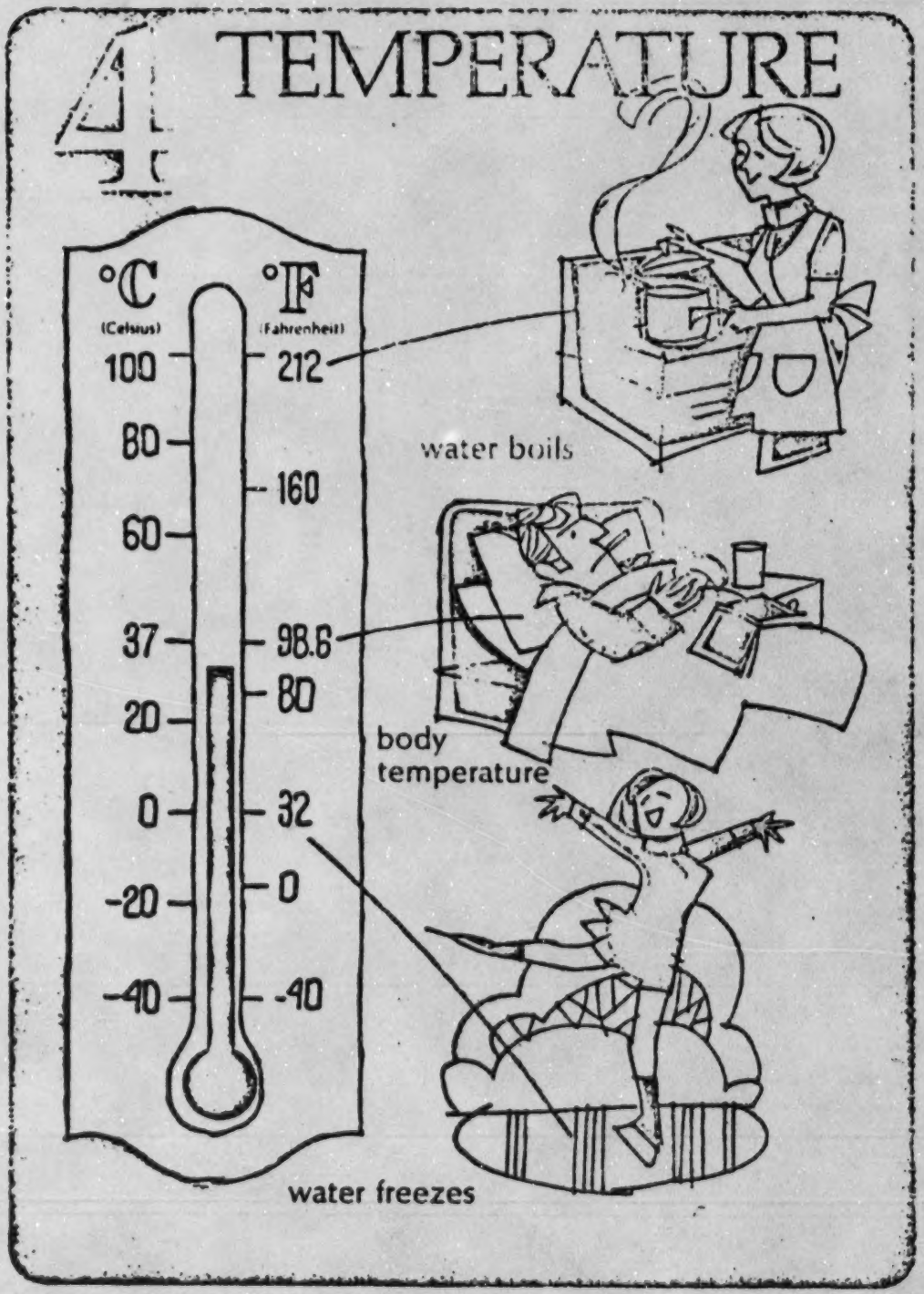


15 milliliters = 1 tablespoon

4 liters = 1.06 gallons

1 liter = 1.06 quarts

500 milliliters
= 1.06 pints


4
TEMPERATURE
°C
(Celsius)
°F
(Fahrenheit)
100
212
80
160
60
37
98.6
20
80
0
32
-20
0
-40
-40
water boils
body
temperature
water freezes

MODULE PRE/POSTTEST

The Metric System

Student_____

Instructor_____

Date_____

Student: This pre/posttest will assess your knowledge of the information presented in this module. You need study only those units that are prescribed on the basis of the pretest results.

1. Give a brief history of the metric system, touching on key points.

2. What is the present status of the metric system in the United States?

3. List reasons for changing to the metric system.

4. The basic metric unit used in measuring length is the _____.

5. The basic metric unit used in measuring mass (weight) is the _____.

6. The basic metric unit used in measuring volume (liquids) is the _____.

7. The metric degree of temperature is called _____.

Pre/posttest (continued)

8. To divide any of the basic units into 100 sections, the prefix _____ is used.

9. To divide any of the basic units into 1,000 sections, the prefix _____ is used.

10. To multiply a basic unit by 1,000, the prefix _____ is used.

11. Driving distance would be measured by _____.

12. What is the seam allowance on a pattern? _____cm.

13. What is comfortable room temperature? _____C.

14. Normal body temperature is _____°C.

Return this test to your instructor for evaluation.

ANSWER KEY
MODULE PRE/POSTTEST

The Metric System

Instructor: Do not reproduce this page in students' booklets. You must retain it for grading and prescriptive purposes. Answers will vary with individuals. A preferred response might be similar to the answer presented.

1. Answer should include points suggested in following paragraph:

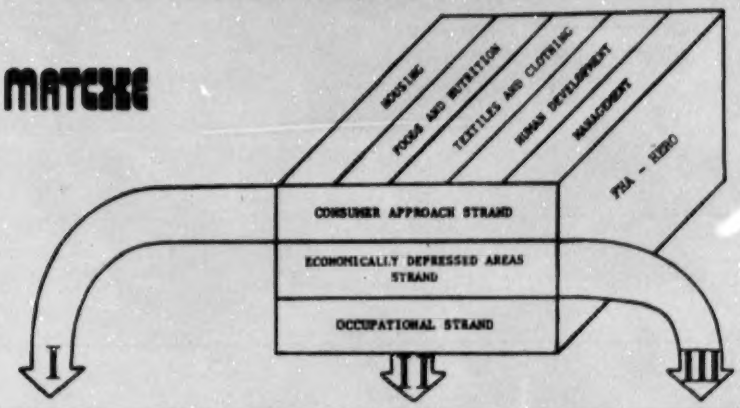
   The metric system originated in France, where it was adopted by the National Assembly on April 7, 1795. Most nations in Europe, and Central and South America adopted it for commercial use during the middle and last half of the 19th Century. Following World War II, the Soviet Union and China made the use of metric units mandatory. India and Japan followed in the 1950s. Britain began a ten-year conversion to the metric system in 1965. South Africa completed the metric conversion in 1975. In 1969 New Zealand began an eight-year conversion to metric units, and in 1970 Australia and Canada announced their commitment to metricate.

2. Use of the metric system in the United States was made legal but not mandatory by an Act of Congress in 1866. Since that time, all United States customary units of measurement have been based upon metric standards. Several bills which would have made the use of the metric system mandatory failed in Congress by very small margins. The United States has slowly been going metric and will likely continue to do so regardless of national plans and policies.

3. a. metric is a universal system
   b. the metric system is easier to use
   c. calculations are faster
   d. less chance of error
   e. interchangeability of machine parts
   f. standardization of tools and gauges
   g. ease of use in the laboratory
   h. eliminates double measuring system
   i. all units divisible by 10 or the multiple of 10.

4.	meter	8.	Centi	12.	3.1 cm
5.	grams	9.	Milli	13.	20°C
6.	liter	10.	Kilo	14.	37°C
7.	Celcius	11.	Kilometer		

MATRIX



	I	II	III
A.	CORE: CONSUMER APPROACH TO HOMEMAKING EDUCATION 1 Life Styles and the Consumer 2 Community Consumer Resources 3 Consumer Rights and Responsibilities 4 Incorporating the Consumer Approach in Homemaking Classes	CORE: ESTABLISHING OCCUPATIONAL PROGRAMS 1 Analyzing Job Market Opportunities 2 Developing Occupational Programs 3 Implementing Occupational Programs 4 Evaluating Occupational Programs	CORE: TEACHING HOME ECONOMICS IN ECONOMICALLY DEPRESSED AREAS 1 Characteristics of Economically Depressed Areas 2 Life Style Characteristics of Economically Depressed Areas 3 Community Resources for Economically Depressed Areas 4 Developing and Implementing Programs for Economically Depressed Areas
	AREA (Module) PACKAGES	AREA (Module) PACKAGES	AREA (Module) PACKAGES
B.	HOUSING 1 Consumer Use of the Community 2 Procedures for Selecting a Community 3 Procedures for Selecting Housing 4 Shopping for a Home Loan 5 Procedures for Selecting Furnishings 6 Maintenance Procedures for Surfaces, Furniture, and Appliances	HOUSING 1 Occupational Opportunities Related to Housing and Interiors 2 Required Skills for Retail Sales of Furnishings and Related Household Items	HOUSING 1 Low Income Housing 2 Government Housing Programs 3 Low Income Furnishings
C.	FOODS AND NUTRITION 1 Technological, Sociological, Ecological, and Environmental Factors Related to Food 2 Regulatory Agencies Responsible for Wholesomeness and Quality of Foods 3 Consumer Aspects in Planning Meals 4 Cultural Food Patterns 5 Influences on Food Prices	FOODS AND NUTRITION 1 Occupational Opportunities Related Foods and Nutrition 2 Operations and Activities of a Food Service Operation 3 Managing a Food Service Operation	FOODS AND NUTRITION 1 Food Availability in Economically Depressed Areas 2 Low Income Food Patterns 3 Meal Management on a Low Income
D.	TEXTILES AND CLOTHING 1 Consumer Approach to Textiles and Clothing 2 Sociological, Psychological, and Economic Factors Affecting Clothing Selection 3 Clothing Needs of Individuals 4 Applications and Implications of New Technology in Textiles and Clothing	TEXTILES AND CLOTHING 1 Occupational Opportunities Related Textiles and Clothing 2 Assembly Line Garment Construction 3 Merchandising Textiles and Ready-To-Wear	TEXTILES AND CLOTHING 1 Clothing the Individual and Family 2 Utilizing Resources for Clothing and Textiles
E.	HUMAN DEVELOPMENT 1 Societal Changes Affecting the Family 2 The Relationship Between Spending Patterns and Interpersonal Relationships 3 Financial Pressures in Various Life Styles and Cycles 4 Individuals and Families in Crisis 5 Consumper Aspects of Parenthood	HUMAN DAVELOPMENT 1 Occupational Opportunities Related to Human Development 2 Children's Center Aide 3 Developing Programs for Preschool Children 4 Convalescent Home Aide	HUMAN DEVELOPMENT 1 Characteristics of Economically Depressed Area Families 2 The Child and the Economically Depressed Area Family 3 Resources for the Economically Depressed Area Family
F.	MANAGEMENT 1 Relationship Between National and Consumer Economics 2 Consumer Legislative Issues 3 Environmental Issues and the Consumer 4 Financial Management 5 Family and Individual Credit Management 6 Management View of the Multiple Role 7 The Metric System	MANAGEMENT 1 Occupational Opportunities Related to Home Management and Supporting Services 2 Occupational Preparation for Jobs Utilizing Housekeeping Skills	MANAGEMENT 1 Management Skills 2 Money Management 3 Marketing Practices in Relation to Low Income Clientele